Chapter 1
Introduction

1-1. Purpose

This manual presents procedural guidance, technical specifications, and quality control (QC) criteria for performing aerial photogrammetric mapping activities.

1-2. Applicability

This manual applies to all major subordinate commands, districts, and laboratories performing and/or contracting for aerial photography and photogrammetric mapping services in support of planning, engineering and design, construction, operation, maintenance, and/or regulation of civil works or military construction projects. This manual is also applicable to US Army Corps of Engineers (USACE) functional areas having responsibility for environmental investigations and studies, archeological investigations, historical preservation studies, hazardous and toxic waste site restoration, structural deformation monitoring investigations, regulatory enforcement activities, and support to Army installation maintenance and repair programs and installation master planning functions. Waivers from applicability should be requested by written memorandum to Headquarters, USACE (ATTN: CECW-EP).

1-3. References

Required and related publications are listed in Appendix A.

1-4. Explanation of Abbreviations and Terms

Photogrammetry terms and abbreviations used in this manual are defined in the Glossary (Appendix B).

1-5. Scope of Manual

This manual provides standard procedures, minimum accuracy requirements, instrumentation and equipment requirements, and QC criteria for photogrammetric mapping. This includes aerial photography and standard line mapping (topographic or planimetric) products, including digital spatial data for use in computer-aided design and drafting (CADD) systems. The manual is intended to be a primary reference specification for contracted photogrammetric services. It should be used as a guide in planning mapping requirements, developing contract specifications, and preparing cost estimates for all phases of aerial photography and photogrammetric mapping. It may also be used as general guidance in executing some phases of photogrammetric mapping with USACE hired-labor forces.

a. Throughout the manual, photogrammetric mapping criteria standards are in specific terms and are normally summarized in tables. Guidance is in more general terms where methodologies are described in readily available references or survey instrumentation operating manuals. Where procedural guidance is otherwise unavailable, it is provided herein.

b. Accuracy specifications, procedural criteria, and QC requirements contained in this manual shall be directly referenced in the scopes of work for Architect-Engineer (A-E) survey services or other third-party survey services. This is intended to assure that uniform and standardized procedures are followed by contract service sources throughout USACE.

c. This manual is intended to cover only those large-scale (i.e., greater than 400 feet (ft) per inch (in.)) photogrammetric mapping products that support typical USACE construction projects. These products include detailed site plan (or planimetry) feature mapping, topographic (vertical terrain) mapping, air photo enlargement plan drawings, and orthophotography mapping. The manual focuses primarily on the preparation of design drawings and other documents associated with these products, including related contracted construction performance activities.

d. Three distinct accuracy classes for USACE photogrammetric mapping products are defined in this manual, together with the detailed criteria, instrumentation, and procedures necessary to meet these accuracy classifications. For each class of map, procedural specifications and limitations are defined, such as allowable types of photographic or mensuration instruments, QC criteria, limiting flight altitude and photo enlargement criteria, and recommended development scales based on project functional requirements.

e. Appendix C contains guidance for project engineers or project managers in developing cost estimates for negotiated qualification-based A-E contracts. This appendix contains an overview of general photogrammetric mapping procedures for those not requiring the detail found in the body of the manual. It therefore may be used independently of the manual for project managers requiring only general background knowledge but needing detailed cost estimating procedural guidance.

1-6. Life Cycle Project Management Integration of Photogrammetric Mapping Throughout the Project Life

Most engineering projects require some degree of surveying and mapping during each stage, i.e., planning, acquisition, design, construction, operation, and maintenance. Therefore, in the early phases of a project, a comprehensive plan should be developed to integrate the surveying and mapping requirements throughout the various stages of the project's life. This would eliminate duplicate surveys performed for different purposes, of different accuracies, for different organizations, and/or at different times.

1-7. Metrics

Both metric (SI) and English (non-SI) systems of measurement in this manual are used due to the common use of both systems throughout the surveying, mapping, and photogrammetric professions. English units of measure are far more common in photogrammetric mapping, with photo and map scales measured in feet per inch (ft/in.), photo coverage usually measured in acres, or occasionally in square miles, flight altitudes in feet, and aerial film/photo dimensions in inches. Camera focal lengths are measured in either inches or millimeters (mm), with "6-in. camera" normally used rather than its 153mm equivalent.

a. Metric scale ratios are rarely used in continental United States (CONUS) civil works or military construction; however, they may be prescribed for some military operational mapping projects. Map scales and air photo plan scales used in engineering, construction, and real estate are normally expressed in mixed English units, or "1 in. = x ft" notation, or more commonly, "x ft/in." An "x-scale" map, another common usage, implies "x ft/in." Unit ratio (i.e., 1:x) scale measures are less commonly used. For example, a 100-scale photo represents a 100-ft/in.-scale photo, or 1 in. = 100 ft, or 1:1,200.

b. Minimum scale limitations given in the manual for either photography or mapping refer to the "inches per foot" ratio measure, meaning that a scale cannot be less (i.e., smaller ratio) than the prescribed scale—e.g., a 100-ft/in. scale is smaller than a 50-ft/in. scale. Due to the variety of mixed measurements, equivalent conversions are not shown in this manual—the most common measurement unit is used for example computations.

In all cases, metric conversions are based exclusively on the US Survey Foot, which equals exactly 1,200/3,937 meters (m). See Chapter 2 for details on the use of other metric conversions used in surveying and mapping.

1-8. Trade Name Exclusions

The citation in this manual of trade names of commercial firms, commercially available mapping products, or photogrammetric instruments does not constitute their official endorsement or approval.

1-9. Accompanying Guide Specifications

To facilitate contracting photogrammetric mapping services, Appendix F, Guide Specification for Photogrammetric Mapping and Aerial Photography Services, has been developed to accompany this manual. This manual is designed to be used in conjunction with the guide specification as a QC and quality assurance (QA) aid in administering contracts for photogrammetric mapping and surveying services.

1-10. Manual Development and Proponency

The Headquarters, USACE, proponent for this manual is the Surveying and Analysis Section, General Engineering Branch, Civil Works Directorate. The manual was developed by the US Army Topographic Engineering Center (USATEC) during the period 1990-1991 under the Civil Works Guidance Update Program, US Army Engineer Waterways Experiment Station. Primary technical authorship and/or review were provided by Ohio State University, Columbus; Virginia Polytechnic Institute and State University, Blacksburg; US Army Engineer Districts, St. Louis, Seattle, Detroit, Tulsa, and Albuquerque; and the Management Association for Private Photogrammetric Surveyors (MAPPS). Recommended corrections or modifications to this manual should be directed to Headquarters, USACE, ATTN: CECW-EP-S, 20 Massachusetts Avenue NW, Washington, DC 20324-1000.

1-11. Distribution

Copies of this manual may be obtained from the USACE Publications Depot, 2803 52nd Avenue, Hyattsville, MD 20781-1102.